

INDOOR AIR QUALITY ASSESSMENT

**Massachusetts Department of Education
Bureau of Special Education Appeals
11 Dartmouth Street
Malden, Massachusetts**



Prepared by:
Massachusetts Department of Public Health
Center for Environmental Health
Emergency Response/Indoor Air Quality Program
March 2006

Background/Introduction

At the request of Ron Minervini, Director of Operations for the Massachusetts Department of Education (MDOE), the Massachusetts Department of Public Health (MDPH), Center for Environmental Health (CEH), provided assistance and consultation regarding indoor air quality concerns at the Bureau of Special Education Appeals (BSEA) located at 11 Dartmouth Street, Malden, Massachusetts. The request was prompted by reported symptoms that occupants attributed to indoor air quality (e.g., sneezing, coughing, sinus pain, exacerbation of allergies, headaches and asthma-like symptoms).

On January 20, 2006, a visit to conduct an indoor air quality assessment at the BSEA was made by Cory Holmes, an Environmental Analyst in CEH's Emergency Response/Indoor Air Quality (ER/IAQ) Program. Mr. Minervini accompanied Mr. Holmes during the assessment.

The BSEA occupies administrative office space on the first and third floors of a three-story, brick building that was originally constructed as two buildings (a theater annex and an office building) in the late 1800s to early 1900s. The two buildings were combined and renovated in 2004, prior to occupancy by the BSEA in October of 2005. Windows are openable in areas along the front of the building only.

Methods

Tests for carbon dioxide, temperature and relative humidity were conducted with the TSI, Q-Trak, IAQ Monitor, Model 8551. MDPH staff also performed visual inspection of building materials for water damage and/or microbial growth.

Results

The BSEA has an employee population of approximately 22 and can be visited by up to 30 individuals daily. The tests were taken during normal operations. Test results appear in Table 1.

Discussion

Ventilation

It can be seen from Table 1 that carbon dioxide levels were below 800 parts per million (ppm) in all areas surveyed, indicating adequate air exchange. It is important to note however, that most areas were sparsely populated at the time of the assessment. Low occupancy can greatly reduce carbon dioxide levels. The heating, ventilating and air conditioning (HVAC) system consists of rooftop air handling units (AHUs), which provide conditioned outside air through ducted ceiling vents. Air is drawn into the ceiling plenum via spaces around lighting fixtures and returned to the AHUs by return vents located above the ceiling tile system. This system was operating throughout the building during the assessment. Mr. Minervini reported that the AHUs are serviced under a preventative maintenance plan where filters are scheduled to be changed every three months. AHUs are equipped with medium efficiency pleated air filters.

Thermostats that control the HVAC system have fan settings of “on” and “automatic”. Thermostats were set to the fan “on” setting (Picture 1) providing continuous airflow, which is recommended by the MDPH. The “automatic” setting on the thermostat activates the

HVAC system at a preset temperature. Once the preset temperature is reached, the HVAC system is deactivated.

To maximize air exchange, the MDPH recommends that both supply and exhaust ventilation operate continuously during periods of occupancy. In order to have proper ventilation with a mechanical ventilation system, the systems must be balanced subsequent to installation to provide an adequate amount of fresh air to the interior of a room while removing stale air from the room. It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994). The date of the last balancing of these systems was not available at the time of the assessment.

The Massachusetts Building Code requires that each room have a minimum ventilation rate of 20 cubic feet per minute (cfm) per occupant of fresh outside air or openable windows (SBBRS, 1997; BOCA, 1993). The ventilation must be on at all times that the room is occupied. Providing adequate fresh air ventilation with open windows and maintaining the temperature in the comfort range during the cold weather season is impractical. Mechanical ventilation is usually required to provide adequate fresh air ventilation.

Carbon dioxide is not a problem in and of itself. It is used as an indicator of the adequacy of the fresh air ventilation. As carbon dioxide levels rise, it indicates that the ventilating system is malfunctioning or the design occupancy of the room is being exceeded. When this happens, a buildup of common indoor air pollutants can occur, leading to discomfort or health complaints. The Occupational Safety and Health Administration (OSHA) standard for carbon dioxide is 5,000 parts per million parts of air (ppm). Workers may be exposed to this level for 40 hours/week, based on a time-weighted average (OSHA, 1997).

The MDPH uses a guideline of 800 ppm for publicly occupied buildings. A guideline of 600 ppm or less is preferred in schools due to the fact that the majority of occupants are young and considered to be a more sensitive population in the evaluation of environmental health status. Inadequate ventilation and/or elevated temperatures are major causes of complaints such as respiratory, eye, nose and throat irritation, lethargy and headaches. For more information concerning carbon dioxide, please see [Appendix A](#).

Temperature readings ranged from 70° F to 76° F the day of the assessment, which were within the MDPH recommended comfort guidelines. The MDPH recommends that indoor air temperatures be maintained in a range of 70° F to 78° F in order to provide for the comfort of building occupants. Although temperatures were within the MDPH recommended comfort range the day of the assessment, several occupants on the third floor reported that the thermostat in this area is generally set too high and, therefore, office spaces are typically too warm. On the day of the assessment, the thermostat was set to 75° F. In many cases concerning indoor air quality, fluctuations of temperature in occupied spaces are typically experienced, even in a building with an adequate fresh air supply.

The relative humidity measurements in the building ranged from 25 to 32 percent, which were below the MDPH recommended comfort range in all areas the day of the assessment. The MDPH recommends a comfort range of 40 to 60 percent for indoor air relative humidity. Relative humidity levels in the building would be expected to drop during the winter months due to heating. The sensation of dryness and irritation is common in a low relative humidity environment. Low relative humidity is a very common problem during the heating season in the northeast part of the United States.

Microbial/Moisture Concerns

Employees reported concerns over musty/mold like odors in the stairwell. In order for building materials to support mold growth, a source of moisture is necessary, such as roof or plumbing leaks. Identification and elimination of water moistening building materials is necessary to control mold growth. MDPH staff performed a visual examination of the stairwell for signs of water penetration, damage and/or mold growth. All areas appeared dry, and no visible mold growth and/or associated odors were observed/detected on the day of the assessment. It is worth noting, however, that the stairwell consists of unfinished brick/cinder block walls and cement floors that make it prone to dust accumulation (Picture 2). The third floor door to the stairwell had spaces beneath the door where light could be seen penetrating, which can serve as a potential pathway for drafts and dust to migrate into occupied areas (Picture 3).

Plants were noted in several areas. Plants should be properly maintained and equipped with drip pans. Plants should be located away from ventilation sources to prevent aerosolization of dirt, pollen or mold. Plants should not be placed on porous materials, since water damage to porous materials may lead to microbial growth.

Water coolers were located directly on carpeting (Picture 4). Water spillage or overflow of cooler catch basins can result in the wetting of the carpet. In addition, some of the coolers had residue/build-up in the reservoir. These reservoirs are designed to catch excess water during operation and should be emptied/cleaned regularly to prevent microbial and/or bacterial growth.

The US Environmental Protection Agency (US EPA) and the American Conference of Governmental Industrial Hygienists (ACGIH) recommends that porous materials (e.g., carpeting, ceiling tiles) be dried with fans and heating within 24 to 48 hours of becoming wet (US EPA, 2001; ACGIH, 1989). If porous materials are not dried within this time frame, mold growth may occur. Water-damaged porous materials cannot be adequately cleaned to remove mold growth. The application of a mildewcide to moldy porous materials is not recommended.

Other IAQ Evaluations

Building occupants reported irritant symptoms of the respiratory tract and eyes thought to be related to a dry environment. The accumulation of dust on flat surfaces that MDPH staff observed on the day of the assessment may be contributing to such irritant symptoms. Dust, when aerosolized (e.g., from HVAC airflow), can be irritating to the eyes, nose and respiratory tract. In addition, the relative humidity in the building was below the MDPH recommended range. Low relative humidity during the heating season is not unusual in the northeast, but low relative humidity can result in the sensation of dryness and irritation. Unfortunately as mentioned previously, low relative humidity is a common problem during the winter months in New England. Drinking water during the day can help ease some symptoms associated with a dry environment.

MDPH staff also noted the presence of VOC-containing cleaning materials (Picture 5). VOCs (e.g., isopropyl alcohol and monoethanolamine) can be irritating to the eyes, nose and throat (3M, 2000) (Picture 6). When combined, the presence of dust, low relative humidity,

and VOC-containing cleaning materials can exacerbate irritant symptoms and other indoor air quality comfort complaints.

Conclusions/Recommendations

In view of the findings at the time of the visit, the following recommendations are made:

1. Consider re-balancing AHUs. Ventilation industrial standards recommend that mechanical ventilation systems be balanced every five years (SMACNA, 1994).
2. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Drinking water during the day can help ease some symptoms associated with a dry environment (e.g., throat and sinus irritations).
3. Install weather-stripping on bottom of stairwell door on third floor to prevent movement of odors and materials.
4. Ensure plants have drip pans. Examine drip pans periodically for mold growth and disinfect with an appropriate antimicrobial where necessary.
5. Relocate water coolers to non-carpeted areas or place tile or rubber matting underneath water coolers in carpeted areas. Clean and disinfect reservoirs as needed to prevent microbial growth.
6. Clean supply/return vents periodically of accumulated dust.

7. Refer to resource manuals and other related indoor air quality documents for further building-wide evaluations and advice on maintaining public buildings. Copies of these materials are located on the MDPH's website: http://mass.gov/dph/indoor_air

References

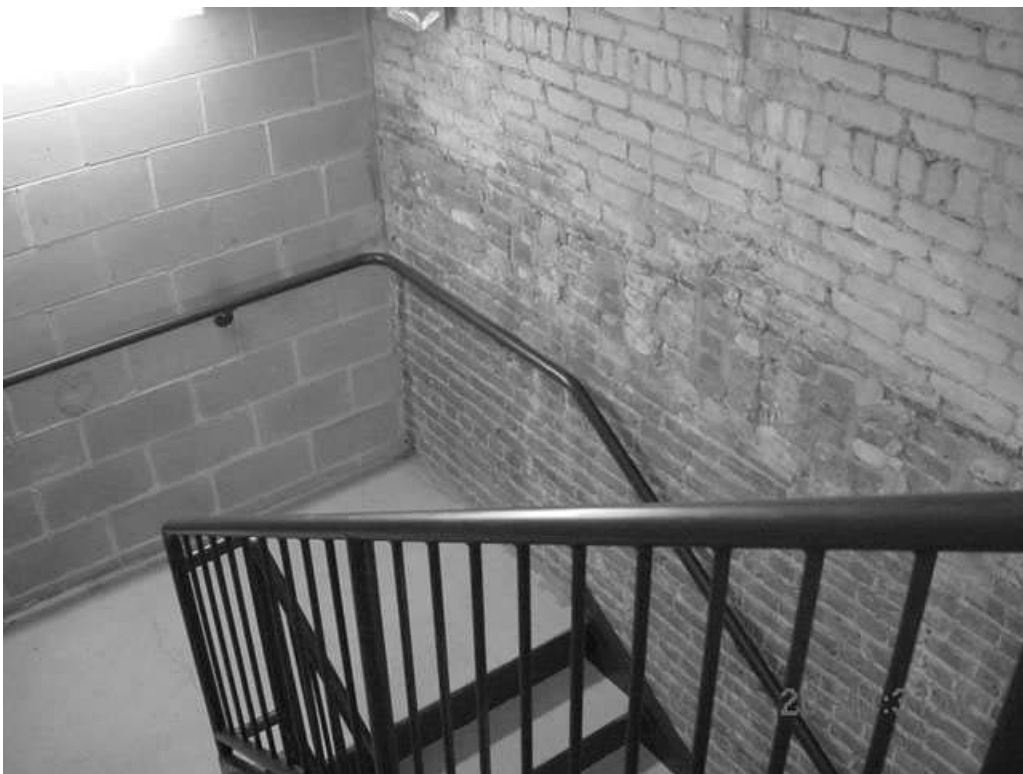
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Picture 1



Thermostat set to Fan “On” Mode

Picture 2



Unfinished Stairwell

Picture 3



Space under Stairwell Door 2nd Floor

Picture 4



Water Cooler on Carpeting

Picture 5



Spray Office Cleaner

Picture 6



Close up of Label on Spray Office Cleaner: Warning! Flammable Contents May Cause Eye Irritation

TABLE 1**Indoor Air Test Results MA DOE/BSEA, 11 Dartmouth Street, Malden, MA****January 20, 2006**

Location	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (*ppm)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Outside (Background)	53	36						Warm, mild-clear skies, winds WSW 15 mph
Byrne	70	32	588	0	N	Y	Y	
Beron	71	31	643	1	N	Y	Y	
Gello	71	30	571	0	N	Y	Y	
Jones	72	29	610	0	N	Y	Y	
McHugh	73	29	644	0	N	Y	Y	
DiGiovanni	73	29	727	0	N	Y	Y	plant
Crane	74	27	587	0	N	Y	Y	
Phongsa	75	27	599	0	N	Y	Y	
Putney-Yaceshyn	75	27	590	0	N	Y	Y	

* ppm = parts per million parts of air

Comfort Guidelines

Carbon Dioxide - < 600 ppm = preferred
600 - 800 ppm = acceptable
> 800 ppm = indicative of ventilation problems

Temperature - 70 - 78 °F
Relative Humidity - 40 - 60%

TABLE 1**Indoor Air Test Results MA DOE/BSEA, 11 Dartmouth Street, Malden, MA****January 20, 2006**

Location	Temp (°F)	Relative Humidity (%)	Carbon Dioxide (*ppm)	Occupants in Room	Windows Openable	Ventilation		Remarks
						Supply	Exhaust	
Sevigny	76	27	735	1	N	Y	Y	
Badolato	75	28	695	1	N	Y	Y	Spray office cleaner-eye irritation (label)
Sherwood	76	25	593	0	N	Y	Y	
O'Brien	76	25	665	0	N	Y	Y	Personal fan-on
Oliver	76	25	638	1	N	Y	Y	
Lilly-Weber	75	25	565	0	N	Y	Y	
Grant	75	25	556	0	N	Y	Y	
Figeroa	75	25	640	1	N	Y	Y	Air purifier
Berman	75	25	643	1	N	Y	Y	Spray cleaner, complaints-stuffy, uncomfortable/hot
Erlichman	74	26	588	1	N	Y	Y	

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						Supply	Exhaust	
Water Cooler Area	74	27	703	0	Y	Y	Y	Cooler on carpet, plants, photo copier
Vacant Admin Office	74	25	581	0	Y	Y	Y	Storage of office items
Women's Restroom	73	28	588	0	N	Y	Y	Spray disinfectant
Men's Restroom	73	27	541	0	N	N	Y	
Stairwell	73	30	488	0	N	N	N	Unfinished, brick walls/cement floor, space under 2 nd floor door
102 Reception	72	27	444	0	N	Y	Y	Water cooler on carpet
Burch/Bares	72	27	440	0	N	Y	Y	Personal fan
Conference Room A	72	27	418	0	N	Y	Y	
Conference Room B	72	27	417	0	N	Y	Y	

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